SCIENCE:

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It appears to be a fact not generally known in the United States that a prize is annually offered by His Majesty, the King of the Belgians, amounting to the sum of twenty-five thousand francs, for the encouragement of intellectual effort.

The intentions of the King were made known by a decree dated the 14th of December, 1874, inviting the authors of all nations to compete, and placing the settlement of the award in the hands of a jury appointed by His Majesty, composed of seven members, three of whom must be Belgians, and four foreigners of different nationalities.

The prize for the year 1881 will be awarded "to the best work on the means of improving ports established on low and sandy coasts like those of Belgium."

The original time for sending in these essays, which may be either printed or in manuscript, was the 1st of January, now last past, but we are authorized in stating that the time has been extended to the 31st day of March, 1881.

Foreigners desiring to compete for this prize are required to send their works to the Minister of the Interior at Brussels; but Mr. John Eaton, U. S. Commissioner of Education, advises competitors in the United States to forward their articles through the Department of State at Washington.

We are informed that the manuscript work obtaining the prize must be published in the course of the year following that in which the prize shall have been awarded, but in what manner the publication shall be made is not stated in the document placed in our hands.

Engineers and scientific men who would avail themselves of this opportunity must act promptly, and we would advise such to apply directly to Mr. John Eaton, of the Bureau of Education, in regard to any further information required for facilitating their work.

CHIMPANZEES IN NEW YORK.

THE last of the Chimpanzees at the New York Aquarium died on the 2d of February, of a throat affection. It was a remarkably well developed specimen. Its principle dimensions were, height (when standing) from heel to vertex 33 inches, distance from coccyx to vertex 20½ inches. Length of foot 6½ inches. Length of hand exactly the same. Its weight was twenty-four pounds. The brain was obtained by Dr. Edward C. Spitzka, making the third brain of this species in his possession. New York has been comparatively rich in anthropoids during the past three years. At one time there were five Chimpanzees and one Orang-Outang on exhibition together. The former lived about nine months. Altogether there have been at different times nine Chimpanzees at the Aquarium. Of the first pair, "Nip" and "Tuck," the former died of a tubercular meningitis, the latter passed successfully through an attack of Enteritis and later of Diphtheria, to die at Coney Island. A comparatively large animal standing over 3½ feet high, died of neoplasm in the lung. A female of depraved propensities such as have not yet been noted in anthropoids (devouring her own excrement), and a little two year old, one of the finest and most active anthropoids yet kept in captivity, died of catarrhal affections contracted at the seaside Aquarium, whither supposed business interest had directed they should go. Two well-developed animals, aged over two years, were sold to the Philadelphia Zoological Gardens.

A single survivor remained at the Aquarium. This animal had been in excellent health for a year and grown considerably during that period. About two years ago a new specimen arrived which had been brought from Africa, after a very stormy voyage, in a sailing vessel; it looked shrivelled and shrunken, weighed nine pounds, and was not expected to live. Those who saw it remarked that it bore the same relation to the other that a starved inmate of a baby farm does to a healthy, well-nourished child. But after a year it had outstripped its comrade in growth, and altogether gained fifteen pounds weight in the two years of its life of captivity. There must be considerable disparity between individual anthropoid apes in a state of nature, and this observation seems to confirm it.

TRICHINÆ IN PORK.

Dr. Ed. W. Germer, Health officer, of Erie, Pa., sends to us a portion of trichinous pork, as a sample of meat which infected a family of seven persons with trichinosis. The pig in question was raised with another, both being fed with the same food and reared under the same conditions. The pigs were killed at the same time, and an examination by Dr. Germer showed that one of these pigs was infected with trichinæ while the other was free from the parasite.

The owner of the diseased pig, his wife and two children were all taken sick simultaneously, and were treated for typhoid fever. Later three persons visited the house and were all seized with the same symptoms. The attending physician attributed the trouble to a well which supplied the family water. The mystery was solved by Dr. Germer who made the discovery of trichinous pork, and under his treatment the patients recovered. Dr. Germer suggests the possibility that many cases of trichinosis occur which are treated for other diseases, and trusts the time is not distant when young physicians will purchase a microscope before buying a gold watch or a gold-headed cane. We have examined the sample of trichinous pork, and confirm Dr. Germer's report; stripping a portion of the sarcolemma from the muscle we found seven trichinæ in the field of the microscope, using a ¼th objective. The trichinæ were in a free condition without cysts, and very transparent; for this reason they could be seen only by making very thin sections,

and would probably have been passed over by one making a careless examination. The Medical *Presse* of Vienna reports 80 cases at one town and 40 at another city, and the more recent fatal cases on board the British School ship *Cornwallis* would appear to suggest the importance of an official examination of all pork to be used for food.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

At the one hundred and ninety-second meeting of the Philosophical Society, of Washington, a very interesting communication was read by Prof. J. W. Chickering, entitled, "Notes on Roan Mountain, North Carolina."

The Appalachian chain with its undulating line of 1300 miles from the promontory of Gaspé on the Gulf of St. Lawrence to Georgia and Alabama, beginning as a series of folds of moderate height, increases in complexity and altitude from north to south, attaining its greatest elevation in the Black Range of North Carolina. Following it from Gaspé to the Hudson we find the single chain of the Green Mountains reaching its extreme height in Mt. Mansfield, 4430 feet; the outlying cluster of the White Mountains with Mt. Washington, 6288 feet, and others exceeding 5000 feet; Mt. Katahdin, in Maine, about 5200 feet; the Adirondacks, with Mt. Marcy, 5379 and the Catskills considerably lower. From the Hudson to New River, Va., a distance of 450 miles, it gradually gains both in width and altitude. It consists of many parallel ranges with fertile valleys between, of which the great Valley of Virginia is the largest and best known, and all in reality a part of that Piedmont region. In Pennsylvania the summits vary from 800 to 2500 feet. Towards the south the chains become more numerous and indented, and in Virginia the Peaks of Otter reach 4000 feet. The extreme eastern range is called the Blue Ridge, the extreme western the Cumberland Mountains, or more properly *plateaus*, while the high range or ranges between is in general called the Alleghenies.

From the New River southward, the system becomes more complex. The main chain hitherto called the Blue Ridge is deflected to the west, and for 250-300 miles in a circuitous chain under the names of Iron, Stone, Bald, Great Smoky and Unaska Mountains joins the boundary between North Carolina and Tennessee, rising frequently to a height exceeding 6000 feet. The more easterly range retaining the name of Blue Ridge, having its southern terminus in Caesar's Head in South Carolina, turns abruptly to the northwest and reaches even loftier altitudes, Mitchells Peak being accredited with 6717 feet. In North Carolina these two ranges are more than 50 miles apart, are partially connected by transverse ranges, and for more than 100 miles constitute a great central plateau like that of Colorado on a small scale.

The eastern chain or Blue Ridge is still the watershed, and on the Atlantic slope gives rise to the Roanoke, Catawba, Broad, Saluda and Savannah rivers. On the other side, this area of mountains and plateaus is separated by transverse chains into many deep basins. At the bottom of each runs one of those mountain streams, the New Watanga, Nolechucky, French, Broad and others. These are compelled to cut their way to join the Tennessee through gaps, gorges and defiles in the heart of this great chain, giving us some of the most picturesque scenery to be found on the continent.

In the midst of this region with all three ranges in sight stands Roan Mountain (a Laurentian mass), the State line crossing it at an altitude of 6391 feet. I desire to call attention to some of the peculiarities of the region as contrasted with the northern Appalachians.

Standing upon the summit of Roan we look into seven different States, and command a horizon of 30 to 80 miles. On the north and west the eye catches the Cumberland Range on the horizon, and in the interval the great Cumberland plateau, and and many other ranges, but all as level as if designed for railroad embankments—sometimes not a peak to be seen in 40 miles of crest. On the south is a wilderness of mountains. Guyot gives fifty to sixty with altitudes exceeding 6000 feet, and yet the highest is only 6717, and perhaps forty of them between 6000 and 6500, and hundreds of others 5000 +. The valleys rarely go below 3000 feet. The railroad after leaving Lynchburgh in a few miles reaches 1000 feet, and from that point for nearly 300 miles rarely goes below 1500 feet, and at one point reaches 2550. The true Piedmont region, extending through to Virginia, North and South Carolina, Georgia, Alabama and Tennessee, at an elevation of 1500 to 2500 feet, offers as attractive a region for health and comfort as can be found on the globe.

Uniformity of temperature. During nine weeks the mercury indicated once 75°, seven times 70°+, once 45°, three times 50°—, the general daily variation being between 55° and 65°. The spring a few rods from the hotel, has a temperature of 45°. Equally remarkable was the uniformity of atmospheric pressure, the highest barometer being 24 19, and the lowest 23.87. No wind had a velocity greater than 20 miles an hour, and seldom reached ten miles. The last time I was at Mt. Washington, in August, the mercury was 36° and the wind 40 miles.

Fertility of summit. Instead of the upper 1000 feet being, as in most of the higher northern peaks, a pile of barren rocks with lichens their only vegetation, the summit of Roan and many other peaks is a smooth grassy slope of the most vivid green, dotted with clumps of *Alnus viridis, Rhododendron Catawbiense*, the soil one or two feet deep and black. How this amount of humus was accumulated, and what cause destroyed the forests which its existence seems to indicate as formerly existing are questions not easily answered. The valleys are very fertile and adapted to almost any crop.

At an elevation of 3000 to 4000 feet occurs a belt of the most magnificent forest trees I have ever seen. Hundreds of chestnuts, sugar maples, lindens, tulip trees, yellow beeches, and buck-eyes were seen from four to seven feet in diameter, and rising 70 to 80 feet without a limb. One chestnut measured 24 feet in circumference, and one black cherry 19 feet. Thorn bushes were as large as apple trees, and with dwarf buck-eyes and yellow beeches looked like old orchards of vast extent in the higher levels.

Flora. Ascending the mountain, the vegetation takes on a northern aspect. Hemlocks abound till near the summit, where they are replaced by Abies Fraseri, the characteristic spruce of these summits. Anemone nemorosa, Oxalis acetosella, Rubrus'ordoratus, Aster acuminatus, Habenaria orbiculata, Ribes lacustris and prostratum, Veratrum viride, Lycopodium lucidulum and similar species, remind one of the woods of Maine and New Hampshire. The peculiar flora of the upper 1000 feet greatly resembles in habit those of the White Mountains, but very few are of the same species. Paronychia argyrocoma, Alnus viridis, and a species of Lycopodium are almost the only plants occurring to me as common to the two localities. Anemone Grœnlandensis is replaced by A. glabra; Solidago thyrsoidea by S. glomerata. The species peculiar to these mountains in general are hardly sub-alpine, and thus continuous with similar species further north but rather apparent instances of local variation, many species being confined to very narrow localities. The same is true of the molluscs. On Mt. Washington, a few rods will sometimes give the same plant in bud, flower and fruit, as a north or south exposure, a precipice, or a snow-drift, may retard or accelerate growth. But on these southern mountains no such difference obtains any more than in the valleys below.

On this communication Professor J. W. Powell remarked that the uniformity of altitude of the peaks is a a feature resulting from the fact that the mass out of which they have been carved by erosion possesses a plateau structure. The elevation of that region was dis-

tributed in its effects with an approach to uniformity over a wide extent of country, and was unaccompanied by those sharp flexings or the protrusions of abrupt granitic cores which are encountered in some portions of the Appalachians and other mountain regions. The individual masses and ranges in the Cumberland region are the work of erosion acting upon a broad platform, excavating wide valleys and narrow gorges, leaving the peaks and ridges as cameos and mere remnants of the general degradation of the entire region. Professor Powell exemplified the process by citing the Uinta Mountains as a broad platform similarly carved by an enormous erosion.

Mr. Lester F. Ward then read a communication entitled, "Field and Closet Notes on the Flora of the District of Columbia." Mr. Ward's paper was more comprehensive than its title indicated. He read extracts from a local monograph which he has been preparing on the Flora of the District of Columbia. The work has been done by Mr. Ward in his usual energetic, thorough, and philosophical manner, and presents many points of interest. It will be published in full by the Society.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

The Society met in the lecture room of the National Medical College on Tuesday evening, February 1, Major J. W. Powell in the chair. By the provisions of the Constitution the retiring President is required to deliver his annual address at the meeting succeeding that held for the election of officers, and to review therein the work of the Society during the past year. As before mentioned, the reasons for the publication of elaborate proceedings, existing in the case of other societies, do not obtain here. The President, therefore, in connection with his address, had prepared a pamphlet of 100 pages, in which were embodied abstracts of every paper read during the two years of the Society's existence, together with a brief history of its formation, the two annual addresses, the constitution, and the list of officers and members. The whole constitutes a very important contribution to knowledge.

Major Powell thus presented a classification of the papers and discussed the several subjects treated in their order, namely: Archæology, ethnography, linguistics, biology, philosophy, technology, sociology, and mythology. As the address will appear in full as a part of the pamphlet, it is not necessary to present an abstract.

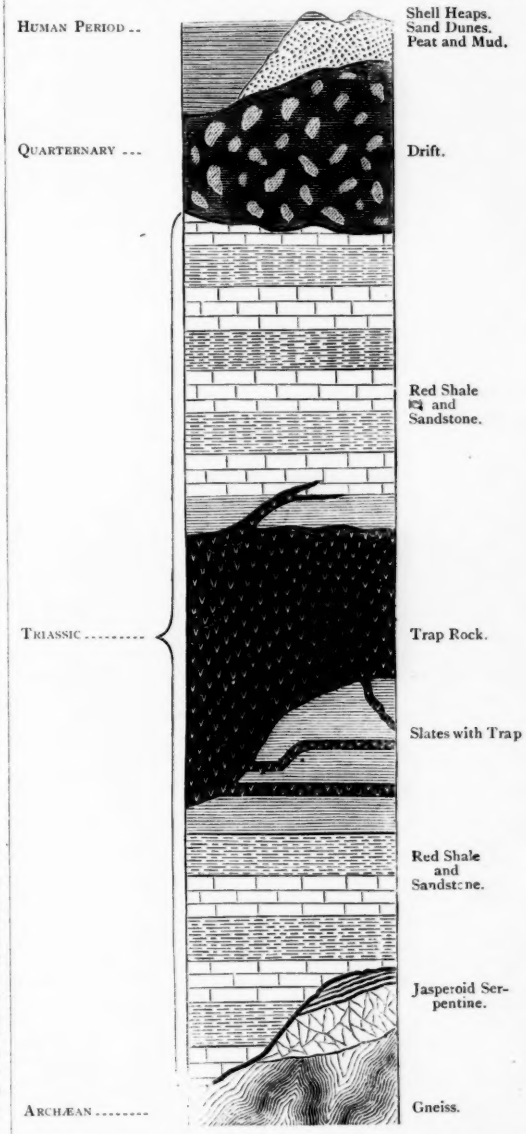
DETERMINATION OF GOLD AND SILVER IN ALLOYS, AFTER QUARTATION WITH CADMIUM.—Two portions of the alloy, each of 0.25 grms., are weighed off and placed with the cadmium in small porcelain vessels. A piece of potassium cyanide is melted in a porcelain capsule over the flame, and the metal thrown in. The melting together takes place readily, and is complete in a few minutes. By changing with two or three porcelain capsules, and having a vessel with warm water at hand, in which the melted portion is dissolved when sufficiently cool, twenty to thirty meltings can be executed in an hour. The two metallic granules are now thrown together into a small long-necked flask, in which is nitric acid of sp. gr. 1.30; a piece of wood charcoal is introduced to prevent bumping—which would rupture the globules—and heat is gently applied. The first solution lasts rather long, according to the proportion of gold; *e.g.*, an hour in case of fine gold. The solution is poured off, the boiling repeated with nitric acid of sp. gr. 1.3 for ten minutes, the liquid again poured off, the globules rinsed with hot water, boiled for five minutes with water, which is poured off, and the flask filled with water is inverted into a porous earthern crucible, dried, ignited strongly, proceeding as in cupellation. In most cases the globules can be weighed separately. Silver is determined in the solution of titration with ammonium sulphocyanide according to Volhard's method.—FR. KRAUS.

A SKETCH OF THE GEOLOGY OF HUDSON COUNTY, N. J.*

BY ISRAEL C. RUSSELL.

An outline of the geology of Hudson County, N. J., is delineated in the accompanying generalized section.

FIG. 1—GENERALIZED SECTION OF THE ROCKS OF HUDSON COUNTY, N. J.



At the base of the series is crystalline gneiss of Archæan age, which is exposed in a few reefs along the shore of the Hudson in Jersey City. These rocks are composed mainly of quartz, feldspar and mica, and form highly crystalline gneiss, mica schist, hornblende schist, etc., and are not to be distinguished from the rocks of

* Taken from a paper published in the Annals of the N. J. Academy of Sciences, Vol. II., No. 2, pp. 27-80.

the same formation exposed so abundantly on Manhattan Island.

Associated with the crystalline Archæan rocks that to a limited extent border Hudson County on the east, are beds of quartzite and serpentine, exposed in the bluff known as Castle Point at Hoboken. This premontory is about thirty acres in area, and is limited on the east by bold bluffs of serpentine. The rock here exhibits considerable variety, being sometimes yellowish and dull in appearance, and so earthy as to crumble between the fingers; again it is compact, dark green in color, and furnishes an ornamental, although interior, building stone. This rock is a silicate of magnesia containing chrome-iron in scattered grains, and furnishes also the minerals *marmolite, brucite, nemalite* and *magnesite*.

The quartzite or jasperoid rock, occurring on the southern slope of the serpentine, in the neighborhood of the Stevens Institute, has, together with the serpentine, been referred to the Archæan series, but as the exposures are now obliterated little can be said concerning it.

TRIASSIC ROCKS.

In Hudson county we have a portion of the eastern border of the Triassic formation which forms a band thirty miles broad across the State. In general with the Triassic formation in New Jersey and the Connecticut Valley, the rocks are here felspathic sandstones, slates and shales traversed by sheets and dikes of trap. The sedimentary rocks occupy nearly the whole area of the county and dip uniformly to the northwest at an angle of about 15°. The sandstone is largely composed of granules or fragments of felspar, cemented by oxide of iron to which the reddish or brownish color of the rock is due; this is the stone so largely used for architectual purposes in New York and the neighboring cities. Traversing these inclined beds of sedimentary rocks, and in a general way conformable with them, are sheets of intrusive trap, which now owing to unequal erosion, form the most prominent features in the topography of the county. This statement holds good, also, for the entire Triassic area in New Jersey, and with more or less accuracy for this formation in general along the Atlantic slope. The main trap ridge in Hudson County, composing the highland known in different portions of its course as Bergen Hill, Jersey City Heights, and the Heights of Weehawken, is continued northward with increasing height, and forms the bold picturesque shore of the Hudson as far northward as Haverstraw. The outcropping edge of the trap, especially in Hudson County, has been abraded by glacial action so as to form an irregular, badly drained, plane surface. Although in a general way following the bedding of the associated slates and sandstone, the trap sheet is really unconformable to them and breaks across their bedding in various places. From both the upper and lower surfaces of the main trap sheet smaller sheets and dikes of molten rock have been intruded among the stratified beds. Examples of these branches from the principal mass may be seen at the base of the cliffs along the west bank of the Hudson, from Hoboken northward. Secondary sheets originating from the upper surface also appear on the western border of Bergen Hill, where they have been accented by erosion. The intrusive nature of the trap sheets and dikes is shown by their crystalline structure, their unconformity to the inclosing stratified beds, and by the metamorphism produced in the strata with which they have come in contact. A section exposed in the cliffs bordering the Hudson a few miles north of Hoboken, is given in the following figure, and illustrates especially the abrupt manner in which the New Jersey Triassic area is cut off along its eastern border.

In the diagram D represents the sheet of drift that covers the eroded surface of the hill, and S the slates that unconformably underlie the trap into which a small

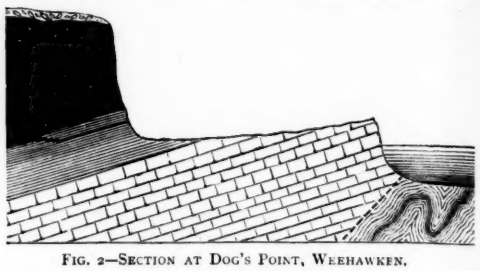


FIG. 2—SECTION AT DOG'S POINT, WEEHAWKEN.

secondary sheet of the crystalline rock has been intruded. Beneath the slates are beds of light colored felspathic sandstone ending in a cliff at the water's edge; the whole series has the usual dip of 15° N. W.

The irregular line formed by the eastern boundary of the trap is caused, at least in two instances, by sheets of trap that leave the main mass at an angle and stand out in ridges tangent to the principal line of cliffs; examples of this feature, which is difficult of description without illustrations, may be seen at Kings Point, Wehawken and Fairmont Hill, Jersey City.

POST-TRIASSIC HISTORY.

No records are found in Hudson County, of the Jurassic cretaceous or Tertiary periods during all these geological ages; the area under discussion must have been a land surface exposed to subaerial denudation. The same destructive agencies were at work, too, with accelerated energy during the Quaternary period. The result is that we have but a decimal portion of the original Triassic formation remaining.

During the Quaternary, northern New Jersey, in common with a great area in the northeastern part of the continent, was buried beneath glaciers of great thickness. In Hudson County the ice-sheet moved from north-west to south-east, ploughing out in its journey the soft Triassic shales and sandstones, and grinding off the projecting ridges of trap with a force so irresistable that a mountain-ridge like the Palisade range could not deflect it from its course. When the climate ameliorated and the glaciers retreated northward, the hard crystalline trap was left with a polished surface that glitters in the sun light, and is crossed by deeply engraved lines that faithfully record the direction from which the glaciers came. In places the rock rises into smoothly rounded hillocks, forming typical *roches moutonnées*. The load that the glaciers carried was spread over valleys and uplands, forming a continuous sheet of glacial drift, which now composes the immediate surface of a large portion of the county. This glacial drift is generally a tenacious clayey deposit, at times fifteen or twenty feet thick, of a reddish color, derived from the debris of Triassic shales and sandstones that enter largly into its composition. Scattered through it are boulders of trap, sandstone, slate, etc., that have been transported but a short distance, and others of gneiss and conglomerate, the parent ledges of which are thirty or forty miles to the northwestward. Hudson county also furnishes examples of modified drift, consisting of irregular layers of sand, gravel and small boulders, all well rounded and plainly assorted and deposited through the agency of running water.

More recent than the glacial deposits are the sand dunes that skirt the base of the upland on all sides. Again more recent than the hills of æolian sand are the many deposits of peat and mud still in process of formation along nearly the whole water-front of the county.

The bed-rock in Hudson county is, in most places, excepting on the uplands, deeply covered by Quarternary and recent deposits. The topography of the rocky floor of the county and of the neighboring portions of New

York, would not only be of great interest to the geologist but of direct economic importance to all interested in shipping, harbor improvements, reclamation of land, etc. The records of deep wells and soundings in the salt marshes that have a bearing on this subject are tabulated in the paper published by the Academy. On the Newark Meadows and in Newark Bay the rock bottom is from two to three hundred feet below the present surface. East of Bergen Hill soundings show a depth to rock nearly as great. The following list taken from the tables mentioned above, give some of the soundings on the borders of the deeply eroded channels of the Hudson, East and Harlem rivers:

Hudson River, foot of 23d st., 250 feet from the east building line of the river street	175 ft. to rock.
Hudson River, foot of Bethune st., 20 ft. W. of bulkhead line	176 ft. rock not reached
Hudson River, pier 60 (old No.), 20 feet W. of bulkhead line	175 ft. to rock
East River, N. Y. Tower of Brooklyn Bridge	107.4 ft. to bed rock
East River, Brooklyn Tower of Brooklyn Bridge	88 " "
East River, pier 41, N. Y, 200 ft. from the building line of South st.	91 " "
East River, pier 18, 200 ft. from the building line of South st	60 " "
Harlem River at High Bridge, centre of river	70 ft. rock not reached
Harlem River, Madison av. Bridge, centre of river	75 " " "
As shown on the Coast Survey Charts of New York harbor, the water in the Hudson off Castle Point is	50–65 ft. deep
In East River, W. of Blackwell's Island	107 " "
In East River, at Hell Gate	121 " "
" " near Ward's Island	170 " "
In New York Harbor	60–80 " "
In the Narrows	60–116 " "
In the Kill Von Kull	25–54 " "
In Arthur's Kill	20–35 " "

These measurements, none of which give the maximum depth of the old channels, clearly prove that the drainage system about New York was at no very distant time several hundred feet below the present water surface. It might be shown with equal certainty that we are living many thousands of feet below what would have been the surface of the county had there been no erosion.

THE SOULS OF PLANTS AND ANIMALS.

By the Rev. Dr. Thomas Hill.

The only things concerning which we can arrive at absolute certainty are space, time and spirit. Their existence and some of their attributes are announced in every act of self-consciousness. Their existence and attributes are not matters of inference, but of direct sight. Matter, on the other hand, can substantiate its existence only by inference from these primal truths of space, time and spirit. All natural sciences are matters of mere deduction from the data furnished by mathematics and mental philosophy. All the business of life, (our manufactures, commerce, history), relating primarily to material things, rests in the same way, ultimately on truths of space, time and spirit; that is on mathematics and philosophy. The conclusions at which we arrive in the historical and natural sciences are therefore more or less probable; and the probability may reach a degree that is practically indistinguishable from certainty. I am practically as sure that this sheet of paper would burn if I held it in the gas jet, as I am that two straight lines cannot enclose a space. Nevertheless the first truth is a matter of contingency and probability, the second of absolute knowledge. These truths of absolute certainty, of direct intuition, concerning space, time and self-conscious mind, are not contingent; they remain true, though heaven and earth pass away, and the perception of them is that which puts the stamp of immortality on the human mind.

But in addition to these fields of direct sight, the three fields of truth outside the conscious mind, are of the highest value. In the first place the certainty of the existence of other minds, is as near absolute certainty as it is possible for a truth of inference to be. That there are other men about me, and there is an Infinite Mind above us all, are truths which are practically as certain as the axioms of geometry. In the second place my fellow men are acting and have been acting, thinking, writing, painting, composing, legislating, warring and making peace, manufacturing and inventing for thousand of years; and the study of their history is the richest and most fruitful method of developing my own powers, and learning to know myself. In the third place the field of space and time in which their history is cast is full of this wondrous matter, which gives them their opportunities, their means, their tools; without it mental or moral life is inconceivable; consciousness itself is awakened to activity only through contact with matter; space and time are visible only through motion as a phenomenon of matter.

Here then is a great object of study, worthy of man's thought. Socrates was fearful lest Plato should spend too much time on questions relating to the measurement of matter; Dr. Johnson in the Rambler carried Socrates's implied censure much farther than the old philosopher himself would have done. Swift in his voyage to Laputa satirizes the students of physical science; the newspapers of our own day indulge occasionally in laughing at the technicalities of the scientific man; even men as wise as the Autocrat of the Breakfast Table utter occasional words of disparagement in speaking of scientific pursuits. But Plato's geometry has done as much for the intellectual and purely spiritual development of our race as Socrates's morality; and the physical philosophers of Europe, during the past three centuries, have, despite their own frequent ignorance of spiritual things, been of immense advantage to spiritual philosophy.

The relations of space are the earliest object of our scientific research. The first really intellectual ideas in a child's mind are those of geometric form. Hence all sciences that flow directly from geometrical relations are likely to be earliest developed. Mechanics preceded chemistry, and the classification of plants and animals by their outward forms preceded the knowledge of physiology, animal or vegetable.

Let us look then a moment at the geometrical study of material things, and see what it involves. Material forms suggest to the child the consideration of shape. He early learns to abstract form from the outward things and compare likeness in form only. He is but a few months old when the smallest drawing of a man, a dog, or cat, is recognized at sight. In a few years he takes the further step of looking by reason beyond the picture of imagination, and seeing the unimaginable realities in space itself. He conceives, for example, a sphere. But that portion of space which lies in a given sphere, surrounding a given point, has no properties by which it is distinguished from other parts of space. This is the Leibnitzian argument by which some modern writers would disprove the existence of space; that its parts are indistinguishable and therefore coincident. But the geometer answers: No! by an act of mind I seize upon any point of space and hold it as the centre of any sphere I wish to consider. When he has thus seized upon and considered a portion of space, bounded and separated from the surrounding space, by an act of his pure intel-

lection, he can communicate his thoughts to his fellowmen in either of two ways; first, scientifically by the medium of conventional symbols or language; and second, artistically, by a model or a drawing. This second method reaches a larger audience. What I write concerning a sphere, for example, can be understood only by those who have learned the language in which I write. But if I illustrate my propositions by good drawings or good models, the thought will be grasped by persons unlearned in mathematics—and persons of all nations, whether they understand English or not.

A form or model is therefore the clearest and most complete statement of a mathematical truth. Nor can a person give a more convincing proof of his understanding a truth than his ready and accurate drawing of an original diagram illustrating it. When we see material particles, the fine particles of crayon, for example, on the blackboard, obeying geometrical law, we recognize at once the expression of geometric thought. Law is a mental reduction of particulars to mental order. A geometric locus is a space in which each point is mentally referable to a single proposition; that is, a space in which the position of every point can be mentally grasped and defined by giving properly the position of one of them. When therefore we see numerous particles of matter conforming to a geometric locus, we are forced to believe that that mass of matter was moulded, directly or indirectly, by a mind which comprehended the law of the locus; and in the moulding of it, enounced the condition which defines the position of its points. The enunciation of a thought can come only from a mind comprehending that thought; and the formation of a geometric figure is the clearest enunciation of a geometric thought.

In the physical forces, therefore, which govern inorganic matter, is revealed the existence of a guiding intellect, since the forces are constantly producing perfect geometrical forms or leading to harmonious arithmetical relations. If we are forced to believe that gravity and chemical differences and chemical affinities inhere in matter, we must still, from the geometrical and algebraical powers exhibited by these forces, believe that they were bestowed upon matter by an intelligent power, who oresaw and comprehended their effects. The study of the natural sciences might otherwise well be given over to the reproach of Dr. Johnson in the Rambler, and Swift in the voyage to Laputa. Without a faith that law lies hidden in the material world, all the efforts of scientific explorers would be paralyzed; and without faith that that law is the choice of infinite wisdom, and adapted perfectly to fulfil the purposes of infinite love, the success of the scientific explorer in discovering it would be robbed of its highest and peculiar value.

In fact, the physical forces governing inorganic matter, acting under definite laws, and tending towards a state of stable equilibrium, nevertheless show in the intellectual, the geometrical and algebraical nature of those laws, a spiritual origin; they show that, however independent of will we may now conceive them to be, they nevertheless are the embodiment of thought; and we know of no way of embodying thought without a volition.

But if the Creator has thus stored in crystallizable matter, in a manner transcending all our thoughts, forces which carry out His geometrical and algebraical conceptions, much more marvellous and beautiful are the modes in which he has imparted to the souls of plants and animals (if I may thus extend the use of the word soul) the power of carrying into execution more complicated geometrical and algebraic plans.

For in every organized being, plant or animal, there is a guiding principle which we may call, if we please, a soul, which causes the forces of matter no longer to act under laws tending towards stable equilibrium, but under a variety of laws, different in each species, tending not towards stable but towards unstable equilibrium. This guiding principle has in itself no forces. The most careful investigators of the phenomena of organic growth fail to find any evidence of vital *force*, although there is abundant evidence which must convince the most careless observer that there is in organized growth a vital *guidance* of force peculiar to each species of plant or animal, which I cannot conceive as inherent like the physical forces in matter and which I therefore, must attribute either directly to the Deity, or to an animal or vegetable psyche, empowered by him to carry out these higher geometric forms, just as in each species of matter he has implanted the ability to carry out the simpler geometrical forms of crystals.

There are those whose philosophy differs from mine, and who hold to the opinion that the vital guiding principle in organic growth, and even the rational soul of men and animals are inherent in matter, in the same manner as the forces which they guide are inherent in matter. According to this philosophy the vital principle and the rational principle, inherent in matter, are usually latent and are brought into operation only under peculiar combinations of circumstances.

Now even should we grant the soundness of this view, I should still find it necessary, for the explanation of the logical series of vegetable and animal forms, to suppose that this universally diffused vital principle originally sprang from an intelligent self-conscious being who comprehends the laws of geometry perfectly; and who has expressed certain of his geometric thoughts through the psyche or soul of plants and animals, whether we suppose that psyche diffused but latent through all matter, or confined to the organisms in which it is patent.

The nature of this psyche, of course, transcends our knowledge. We recognize it only through its operations; and consciousness aids us in our attempts to understand it only so far as to show that its effects are intellectually identical in geometric form with the product of our geometric imagination. But we cannot suppose the psyche of the plant or animal conscious of all the thoughts which it develops, since we, whose psychical development is evidently vastly higher than that of any other terrestrial beings, are not conscious of the geometric law of our own bodies, which our souls unconsciously fulfill; not only during the period of our growth, but daily as we supply by nutrition the daily waste of the frame.

The fact that the plant or animal may, without the exertion of any mechanical force, guide the forces of electricity, and light and heat and chemical affinity, to the building of peculiar forms imprinted on its own soul, may receive a coarse illustration from the operations of the steam-engine in which, by delicacy and accuracy of workmanship, the direction given to the power can be changed by a force infinitesimal in comparison to the force exerted by the engine. The chemical forces which govern the organogens in their compounds are always the same, but the results vary for each individual plant or animal, and the law which those results indicate is different for each species. The forces, building out of these few simple elements so great a variety of forms, are tremendous in their energies, and their existence is forced upon the attention of the naturalist; but the vital force, if such a thing exist, which guides these tremendous powers and determines what result they shall bring to pass, has eluded the sight of the most careful and accurate observers. The nicer the investigation into the phenomena of organic form, the more wonderful do the results appear. The persistence of type, for example, through successive generations for many thousands of years, and the very evident transmission of all physical and psychical characteristics from the male parent to the offspring, how utterly inexplicable upon any gross material theory, when we reflect that from the male parent no

matter passes into the offspring, excepting the fluid contents of a microscopic cell strained through its walls and through the walls of the ovule or ovum! Through this infinitesimal quantity of fluid, filtered through this infinitely close double filter, there passes, in some way, a law of form, and a law of mental and physical idiosyncrasy which is stamped upon the whole terrestrial being of the offspring, bending all the untold energies of gravity and of chemical and electrical attraction, to its own particular whim. Through the whole terrestrial life of the offspring do I say?—yes, and I may include in that word offspring sometimes the whole progeny for a thousand generations. The conscious part of the soul is still less known. Its presence is one of the characteristics of animal as distinguished from vegetable life, and the investigation of its comparative development in different tribes of animals is the most valuable part of the field of natural history.

The soul of the plant is presumed to be unconscious. The phenomena of motion in the sensitive plants, and in the efforts of all plants to throw their leaves to the light and their roots to the richest spots in the soil, are supposed to be as unconscious as the contraction and dilatation of the pupil of the human eye. In that dilatation and contraction there is action adapted instantly to circumstances, and so long as the eye is healthy, with unerring promptitude and accuracy. An observer of the human animal might quote this as evidence of the wisdom of man. But on further thought he might see in the very fact that the action is unerring, evidence that it did not depend on the conscious volition of a finite being. And we, men, know that it is a movement of which we are absolutely unconscious.

In like manner it is presumed by the majority of investigators, that all the movements of plants are made with absolute unconsciousness on the part of the plant, and that plants have in short no consciousness whatever, either of their own existence, or of the existence of a world about them. Now it does not follow that on this account the plant is to be studied in its physical relations alone. It has psychical relations also, of the greatest interest to a true enthusiast in botany. The gardener and the botanist constantly speak of the feelings and tastes of plants, and of their moral qualities—indeed some plants have been named from moral nature, as, for example, Rumex patientia, and Carduus benedictus, the patient dock and the blessed thistle—while others have moral epithets that have become as familiar as their names, as, for example, the modest violet and the flaunting poppy.

The geographical distribution of plants will, I think, be found to depend upon something which eludes our study of the external conditions; something besides that physical struggle for life which the English naturalists see in every part of the animal and vegetable kingdom, as though the poor in those kingdoms were oppressed by unjust and impolitic laws impeding the distribution of land, as they are in the kingdom of Great Britain. There is also what may be called a choice in the plants, not implying by that language any consciousness in the plant, but simply affirming that its flourishing here or perishing there, depends in a great measure upon an idiosyncrasy of constitution, making it sensitive to physical changes that can be measured neither by the thermometer, barometer, hygrometer, electrometer nor chemist's balance. The mayflower of New England, called elsewhere trailing arbutus, will adapt itself, when it chooses, to clay or sand, to deep shaded woods or to sunniest hillsides; and I never saw it so flourishing as once in a peat meadow over which it was slily creeping from a sand bank on its edge. But take the plant up with never so much care, and with never so large a sod of unbroken earth about its root, and transplant it where you will, and it is a hundred to one that it dies in a twelvemonth of a broken heart, pining for its old home. Some of these freaks have been explained by the discovery that some plants are semi-parasitic, stealing from the roots of others a part of their food, and therefore incapable of living except in the presence of their patrons,—but many remain yet unexplained.

It sesms to me, however, very plain that the souls of plants, that which makes the difference between a plant living in the forest, and the specimen in the herbarium, that which guides the forces of nature to the building of the plant, and which turns its leaves to the light, is worthy of study in all its relations. It is a depository of divine thought, deposited there ultimately for our instruction as one of its final causes and therefore worthy of the most careful attention.

The intellectual and moral development of animals is also doubtless governed by a plan. The difference between the dull oyster and intelligent, affectionate dog, is as much the result of a plan, or thought, of the Creator, as is the difference of their forms. The horse and the ox are as admirably adapted to domestication by their mental as by their bodily gifts. All the instincts of all animals are adapted to their organization and to the nature of the world and of other animals among which they are placed.

Even should we suppose that the mental power of animals is the result of their organization, that is to say, even if we should suppose that mental power is latent in matter, and simply rendered active by organization, we should be compelled, upon a thorough study of the mental development of animals, to admit that their souls can be classified upon a logical plan, just as their forms can be; and we should be forced to admit, that this latent soul in matter is capable not only of organizing matter according to a logically developed series of forms, but of eliminating out of its own totality separate minds in a progressive series logically connected.

The very great importance of this study of comparative psychology, of becoming acquainted with the mental and moral characters of animals, is obvious. Many attempts to found a science of comparative psychology have been undertaken. But the field is vast, and the progress of the survey slow. At the Baltimore meeting of the American Association for the advancement of Science, Dr. Weinland proposed a method for this new science, ingenious and sound, but by no means exhaustive. He lays down nine fundamental principles; first, that the distinguishing mark of an animal is its consciousness of an outer world; secondly, that this consciousness of an outer world is the fundamental principle of the soul of animals; thirdly, that the consciousness of self results from and is proportioned to the consciousness of the outer world; fourthly, the degree of psychical development can be judged from the degree of development of the consciousness of an outer world; fifthly, this may be judged from the development of the organs of that consciousness; sixthly, these organs are of three kinds, those receptive of sensations, reflective organs and the organs of voluntary motion; seventhly, we may depend in comparative psychology mainly upon a study of the organs of voluntary motion; eighthly, these motions may be divided into two classes, those which refer only to the animal himself, and those by which he would hold communication with other animals; ninthly, man stands at the head of all animals, since his voluntary motions are not only more numerous and perfect than those of other animals, but because through machinery he increases vastly the number of his organs, runs upon the locomotive, talks through the printing press and telegram, and shows us what is most distant through the telescope and stereoscope.

But it is impossible for us to understand any of the phenomena of consciousness save through an appeal to our own consciousness. The mere investigation of the

organs of an animal and its movements can give no true knowledge of the soul of an animal to one who is incapable of analyzing carefully the phases of his own consciousness; nor would the student who is the most thorough master of the analysis of his own thought and feeling, be able to understand the souls of animals, did not the human spirit contain in itself the germ of every power of every terrestial creature. The disposition to attribute to others and to animals the feelings which we should have, were we in their circumstances, although it may mislead the student both of human and of animal life, is nevertheless an essential to successful study. It is impossible for us to understand beings either higher or lower in the scale than ourselves, except as they in some degree resemble us. Our knowledge of ourselves must keep equal pace with our knowledge of other beings; else we have no knowledge of either.

To recapitulate: In the study of organized beings we find three principal departments, their anatomy, their physiology, and their psychology. Their anatomy deals with their forms, and with the forms of their parts; and these forms furnish in general complete data for their classification. Physiology treats of the peculiarly modified chemical action by which food is assimilated and made part of the living structure, and by which the various secretions are formed. And were not this a much higher and more difficult inquiry than the study of the forms, we might doubtless classify all plants and animals by the chemical likenesses and differences of their tissues and secretions. At present these characteristics are used in classification only as confirmations of the accuracy of the results obtained by form. Psychology deals with the souls of organized beings, with those principles that guide the chemical and mechanical forces in matter to the formation of the organism. The classification of organized beings by their forms is, in fact, in one sense, a classification by their souls by the psychical principles which are empowered to create the forms. But these unconscious souls have other functions than the creation of forms; they have besides this intellectual work, a sort of moral quality by which they select peculiar food and form peculiar products, and by which also they are aquatic or terrestrial, tropical, tender, hardy, arctic or alpine, &c. Then in animals we have, either in the same soul or in a second one, consciousness added to life, the powers of thought and feeling, desire and volition, and of knowing that they think, feel, desire and will, and these powers culminate on earth in the human race.

Matter is a storehouse of forces; in each atom slumber or rage the forces of attraction and repulsion, and also the moral qualities of chemical difference and identity. These forces, whether chemical or mechanical, act according to fixed laws, and tend towards a state of rest and of stable equilibrium. And they are all so correlated that each of them can be referred as forces, to one common unit, and shown to be capable of lifting such a weight so many feet a second.

But organized beings push always into motion, and their tissues and secretions are usually such that, in air of the same temperature and moisture as that in which they grew, they will rapidly decay the moment that life is gone. They are perhaps in chemical equilibrium; but it can hardly be called stable,—at least it is not stable enough to resist the very heat and atmospheric influences under which it was built. Yet there is no trace of any force in the organism thus compelling the forces of inorganic matter to act in this peculiar way, so different from their behavior when the organizing life is wanting.

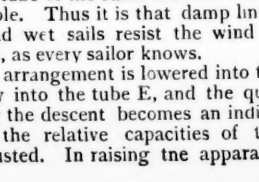
The intellectual power of the unconscious soul is not a force that can be compared with gravity, it cannot be measured by that unit; it does not act by attraction and repulsion, but simply guides (we know not how) the forces which do thus act—it rules them by moral or intellectual, not by corporeal power. The souls of plants and animals have a certain lordship over the earth, and the earth obeys their rule to a certain extent. This lordship is exercised in part involuntarily and unconsciously, that is in the phenomena of nutrition and growth; and in part consciously, in the phenomena of voluntary thought and motion and action. And had we sufficient knowledge of the habits of animals, we could doubtless classify them according to their voluntary life.

But in classifying organized beings, we do not find ourselves imposing law upon the series of species, but discover it already impressed upon them. Not only does the soul of the single organism develop thought, but in the whole gradations of the universe, from the chemical atoms up to the highest orders of mammalia, we find the development of more extensive thoughts; as though the whole universe had a soul; developing it as the soul of the violet develops its forms and color and odor. Now does this soul of the universe act consciously or unconsciously? Shall we take the vegetative power, or the conscious mind, as the type of the Deity? In endeavoring to find a symbol for the Highest in the universe, shall we look for the light of analogy into what is highest in ourselves, the conscious soul? or into what we have in common with the seaweed, the organizing power of life?

To me the answer is evident, that the highest of which we are conscious is the best symbol by which to speak of the Highest who is above our consciousness. Looking thus at the Divine Being as the Lord, who has consciously expressed His thoughts in the material world, that world becomes glorified and glows with heavenly splendor. Natural science becomes the study of the autograph works of an Infinite Author; and natural history—which is the highest of the series of physical sciences, and links them to the sciences that deal with the human mind and the works of man—becomes the means of communion with the highest geometrical, algebraical and chemical thought, which the Father of men has as yet revealed to us; and also becomes through the study of the instincts and reason of animals the fittest of all natural preparations for a study of ourselves, and of our own relations to the All wise and All good.

SIR W. THOMSON'S NEW DEPTH GAUGE.

Sir William Thomson has very recently patented another depth gauge which, though it depends upon capillary action, does not require the co-operation of chemical change. In fact, it operates by capillary action alone. The accompanying figure will illustrate the principle of this new device. Here A and B are two



glass tubes of different diameters united by a capillary tube C. The narrower tube, B, is closed at the end by a plug E, which can be removed at will: and the wider tube A is covered by a sheet of cotton cloth. This cloth acts as a porous septum which, when wetted, is permeable by water but impervious to air. For according to a law of hydrostatics, a film of water in a hole resists a difference of air pressure on its two sides, equal to the hydrostatic pressure due to a column of water in a capillary tube of the same diameter as the narrowest part of the hole. Thus it is that damp linen is impervious to air, and wet sails resist the wind much better than dry ones, as every sailor knows.

When this arrangement is lowered into the sea, water forces its way into the tube E, and the quantity forced into it during the descent becomes an indication of the depth when the relative capacities of the tubes are properly adjusted. In raising the apparatus the water

in the wide tube is gradually expelled by the air, and the wet cloth secures that all of it will be driven out before any air gets in. The water contained in the narrower tube remains to indicate the depth by a suitable scale engraved on the glass, and then is let out by withdrawing the terminal plug.

For actual use the wide inlet tube is made of brass and the narrower tube of glass. Three sets of these tubes are combined into one instrument, and in each set there is a special ratio between the capacities of the inlet and retaining tubes, in order that the set in question may answer for certain depths. Flying soundings are usually taken in depths ranging up to 130 fathoms, and the three sets are designed to indicate depths, say, from 12 to 28 fathoms, from 28 to 60 fathoms, from 60 to 130 fathoms. They are fitted into a brass protecting cylinder, open at one end to the water, and slotted out in the sides to allow the engraved scales on the gauge tubes to be seen from the outside. The whole is then enclosed in a galvanized iron guard-case drilled with small holes to allow the seawater to enter, and being attached to the sinker is lowered into the sea. The apparatus is manufactured by Mr. Whight, of Glasgow, for Sir William Thomson, and it has already been adopted on H. M. S *Valorous*, and the Russian imperial yacht *Livadia*.

While upon this subject we may also draw attention to the "nipper" lead of Mr. Lucas, engineer to the Telegraph Construction and Maintenance Company. The old plan of ascertaining the nature of the sea bottom, by bringing up a specimen of it in a tube, let into the bottom of the sinker and armed with tallow, is open to several objections. For instance, the specimen is apt to get washed out in rising to the surface, and when it is safely brought on board it is usually so smeared with tallow as to be objectionable. The nipper lead of Mr. Lucas, on the other hand, retains what it catches and renders it up in a pure state well fitted for preservation. The bottom of the lead or sinker in question is provided with two hollow claws or spoons, not unlike the mandibles of a crab. These are hinged to the sinker, and open out against the resistance of a stout spiral spring which is contained in the body of the sinker. When fully opened out they are kept apart by a locking device, consisting of two crossbars which meet end to end and fit into each other. The points of the open claws, however, in striking upon the bottom, spring this lock, and the claws snap together with great force, nipping up a specimen of the bottom at the same time, and from their hollow shape this specimen is retained. So effective is the nipper lead that the claws will nip a sheet of paper off a table, and they have been found to raise a specimen of the bottom from 2,000 fathoms.—*Engineering*.

BOTANICAL NOTES.

Every young naturalist needs to be on his guard against deception which is a frequent cause of serious mistakes.

Many strange species and unheard of peculiarities are sometimes discovered by the over zealous and credulous. Most imitations of natural objects are so bungling as to be readily detected, but occasionally something turns up which is such a surprise, that the fact is noted before its improbability is made evident.

The large springs of the limestone districts of Pennsylvania are exceedingly clear, cool and transparent. The principal plants living in them are species of Characeæ, and Veronica Americana, whose large, lettuce-like leaves have a very striking appearance when seen through the sparkling water. While visiting a spring one day in mid-summer, I was surprised to see some strange looking plants which appeared to be Marata cotula. Mentally noting this peculiar position for such a common and well-known weed of dry ground, I caught sight of something still stranger—a garden aster; another step and a zinnia and dahlia came to view. Indeed there was quite a garden "á immersion."

The small boys of the neighborhood had acquired the art of deftly binding flowering branches to small stones which held the plants to the bottom, while the strong upward flow of the water kept them neatly upright and life-like.

The search for plants upon vacant city lots, rubbish piles, and the like, always reveals a greater number and variety of species than one would suppose.

As several of these "local" floras have been published lately, I give one which interested me a good deal at the time of noting it. In Kingsford's Oswego Starch factory, large quantities of lime are used in the manufacture of corn-starch. The refuse lime is a pasty mass still having to a considerable degree the caustic properties of fresh lime. Large quantities of it accumulate about the factory, and are hauled off to get it out of the way. Several hundred loads were once deposited in the middle of a pasture, in a loose pile varying from three to six feet in thickness. Cattle tramped over it carrying more or less mud upon their hoofs, and their droppings collected to a considerable extent upon it. In time plants began to get a foothold there, and one mild day in winter, about three or four years afterward, I visited it, and was surprised to find the following well established: Cirsium, 2 sp., Rumex, Poa, Phleum, Plantago, Graphalium, Verbena, Trifolium, 2 sp., Solidago, Marata, Chenopodium, Polygonum.

The white clover was especially luxuriant, and covered patches of several square feet with a perfect turf.

W. A. B.

A popular work on Algæ, by Rev. A. B. Hervey, to be illustrated with colored plates, is announced.

Professor Alphonso Wood, widely known as the author of a Class-book of Botany and other botanical text-books, died at his residence at West Farms, New York, on the 4th inst.

Trimen's *Journal of Botany*, despite its long standing and being without a rival in its chosen field, is obliged to make a call for a more liberal support in both subscriptions and contributions. This does not speak well for the enthusiasm of English systematists.

The second volume of *The Botany of California* has made its appearance. It includes the remainder of the Phanerogams not treated in Vol. I., the Pteridophytes, and the Mosses, and brings this eminent work to a successful close.

A new manual of the mosses of the United States will be published during the present year. The authors, Leo Lesquereux and Thomas P. James, are the most able and distinguished bryologists of America. The edition will not be large, and for the present the price is fixed by the publishers at $3.00. Such a manual has been needed for a long time.

In *The American Naturalist* for January, Professor Bessey calls attention to the Fly Fungi belonging to the genus *Entomophthora*. They have been but little studied. The most common species (*E. muscæ, Fres.*) infests the house fly. Dead flies are common in autumn covered with a white powder which fastens them to the walls and other objects of the room. Upon examination the bodies are found to be filled with the mycelium of the asexual stage of the fungus, the white powder being the conidial spores. This asexual form is described in many books under the name *Empusa*. The sexual stage develops entirely within the host, filling it with a mass of oöspores and hyphæ. The genus *Tarichium* is founded on this sexual condition of the plant. The two genera Empusa and Tarichium not being antonomous are re-

placed by the genus Entomophthora; but it is proposed by Giard, who has investigated the subject recently, to retain these names to designate the asexual and sexual stages respectively. These plants belong to the interesting order *Saprolegniaceæ*. Other species of the same order are abundant on dead and living fish, cray-fish, etc. They have sometimes proved very destructive to the young fish in hatcheries. The species of the order are not well known, although examples are easily obtained.

J. C. A.

MICROSCOPY.

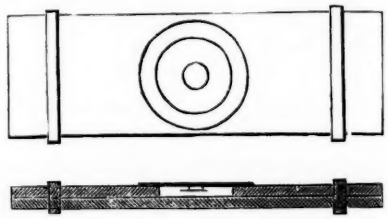
Mr. Julien Deby recently read before the Quekett Microscopical Club a paper describing various special "dodges," which may be employed by microscopists to facilitate their researches.

I. When allowing all but adepts in the use of microscope to peep through my high power glasses, I have often felt a certain degree of uneasiness, not to say of alarm, regarding the fate of valuable test-slides, or still more valuable objectives. Many others here present have no doubt experienced the same discomfort which I find an easy matter to attenuate to a considerable extent, by focussing from the eyepiece instead of from the coarse or the slow motion. All that is needed for this is a rack and pinion to the eyepiece of considerable length. An inch or two up or down corresponds here to a fraction of a turn of the fine adjustment of the microscope, so that very little danger exists of any sudden contact with the covering glass. As soon as an indistinct view of the object is obtained through the ordinary coarse adjustment of the microscope body, the focus is brought to exactness by means of the coarse motion of the eyepiece without much difficulty. For demonstrations or exhibitions in public, microscopes could thus be made without the ordinary fine motion.

II. When mapping with micro-spectroscope, the difficulty of measuring exactly the position of fine lines or absorption bands is often great, even when using the admirable micrometers invented by Mr. Browning and Mr. Sorby. I find that in most practical cases the micro-spectrum can be thrown upon a sheet of white paper by means of an ordinary camera lucida placed over the eyepiece of the spectroscope. Strong light by means of a condenser has to be thrown through the liquid under examination. By means of an ivory rule, finely divided, and brought back to a known line, say D, all other lines or bands may be directly measured off on the rule, and, if desired, the exact results in millionths of a millimetre may then be computed by any of the known interpolation formulæ, such as are given in Suffolk's useful little book.

III. The arrangement of small microscopic objects, such as diatomis, foraminiferæ, etc., on slides in regular lines, circles or patterns, can be much facilitated in the following way: "Draw with a pen and ink cross lines, or circles, or any other figure required on the surface of the plain mirror of the microscope; then focus down until the image of these lines is seen on the upper surface of the top lens of the condenser. By means of a mechanical finger, or of a steady hand with a rest, no difficulty will now be experienced in placing the objects in perfectly regular order.

IV. I now obtain excellent condensed monochromatic light by means of a bull's eye of unusual external shape, the internal portion of which, however, is filled with glycerine or oil of cloves colored to suit. This bull's eye has a plane back and a concavo-convex front, and the liquid is introduced through a hole in the flat side, closed by a small ground stopper. This apparatus is furnished with universal motions, and has a rack and pinion foot. It was made for me by Mr. J. Browning. When using blue light, produced by ammonia sulphate solutions, I have resolved, by means of this monochromatic bull's-eye amphipleura, with objectives in my possession, which will hardly show *Pl urosigma angulatum* under ordinary condenser illumination.



V. Some time ago, Mr. J. E. Ingpen, on my behalf, made a communication to the Club in regard to a growing regard to a growing slide I had devised for some special researches I was following at the time. Some difficulty seems to have been found in the making of these slides, so that it is with pleasure I now offer a still more simple contrivance for obtaining the same results. Here is the receipt: Take an ordinary glass slip with a circular hole, say, half an inch or more in diameter in the middle; lay this slip on an ordinary glass slide, not perforated. Then grease the top of the upper or perforated slide just a little way around the circular hole, and join the two slips of glass by means of two rubber rings (see Fig.). The object is then placed on a thin cover-glass, somewhat larger than the hole in the slide: it is covered by a thin glass cover, ¼ in. in diameter; the whole is then turned down and fastened to the slide by the adherence with the grease, while the small cover prevents the running of the liquid. The plant or animal under examination finds itself confined in a sort of miniature Ward's case. When not under observation, the growing slide is laid flat in a shallow plate with water just above the line of junction of the two slips of glass, where, by capillarity, it creeps up to the central cell, where evaporation keeps the contained atmosphere in a state of constant and healthy saturation.

VI. *Copal Varnish.* I find this varnish dries very rapidly if slightly heated, or even if placed on a previously warmed slide. I have many hundred slides of diatoms prepared in copal varnish, and my friend, Mr. Van Heurck, of Antwerp, who was the first to use this material, has many thousands. The varnish to be used is what is called the "pale copal," and its consistency ought to be that of oil. It is much pleasanter to use than Canada balsam, does not make bubbles, and its refractive index is not very different from that of balsam, and does not interfere with the solution of diatom markings. I have of late made many preparations in copal, dispensing with the cover-glass altogether. The drop of copal is placed on the diatoms and heated lightly over the spirit-lamp. It soon takes the consistency of amber, and is hard enough to sustain wiping and brushing with a soft brush with impunity. The optical aberrations produced by the cover-glass are thus done away with.

ASTRONOMICAL MEMORANDA.

Professor C. A. Young has examined the 70 lines given on Angström's chart as common to two or more substances. Of these 70 lines, 56 were seen distinctly double, or triple; 7 single; and in regard to the remaining 7 there is still an uncertainty. The instrument used was a diffraction spectroscope with collimator and observing telescope, each of 3-inch aperture and about 42 inches focal length, and a Rutherford grating of 17,300 lines to the inch. The apparatus was strapped to a 12-foot equatorial provided with a driving clock, and powers magnifying from 50 to 200 diameters were used. A large prism with a refracting angle of 20° was placed between the object glass of the

equatorial and the sun to throw out the parts of the spectrum not under examination, and a concave cylindrical lens was used next the eye to reduce the apparent width of the spectrum, and thus increase its brightness.

From Professor Young's observations it thus appears that the coincidences are only near approximations, but a careful investigation by bringing together the bright-line spectra of the metals and the solar spectrum must be made in order to settle the question conclusively.

Mr. E. J. Stone has presented to the Royal Astronomical Society the complete sheets of his great Catalogue of Southern Stars, observed during his superintendence of the Royal Observatory, Cape of Good Hope. This very important work contains the places of between twelve and thirteen thousand stars, including, in addition to the stars observed by Lacaille, a considerable number of stars falling within similar limits of magnitude. "A stereographic projection showing the distribution of the stars contained in the Cape Catalogue, 1880, between 110° and 180° N. P. D.," has been lithographed by Mr. Stone.—*Nature.*

W. C. W.

As noted in the issue of last week, the volume of reports on the total eclipse of 1878, has been recently issued from the Naval Observatory at Washington. A few separate copies of the report of Mr. D. P. Todd, assistant in the office of the American Ephemeris and Nautical Almanac, have been reprinted, mainly for distribution among the gentlemen who co-operated in observing the duration of totality along the limits of total eclipse. Besides the usual observations of contacts, Mr. Todd had planned a search for supposed intra-mercurial planets, having provided himself with the four-inch comet seeker belonging to the Naval Observatory. At his station, however (Dallas, Texas), clouds intervened to such an extent that δ Cancri, a fourth magnitude star near the sun, could not be seen. This station was almost the only one of any importance at which clouds interfered on the day of the eclipse. Mr. Todd describes in his report a new method of procedure in the observation of total eclipses, whereby it would seem that the question of the existence of intra-mercurial planets might be speedily settled. An arrangement was concluded between Professor Newcomb (observing in Wyoming), and himself, whereby, if the former should observe any such object, its approximate position should be telegraphed immediately to the southern station for verification—there being about twenty minutes of absolute time intervening the arrival of of the moon's shadow at Wyoming and its reaching Texas. As Professor Newcomb observed no unknown object, there was, of course, no occasion for carrying out this scheme; but it will readily appear that, had the weather been clear at the southern station, and had the position of the objects seen by Professor Watson, been telegraphed for verification, the question of small planets near the sun might have been in a much less uncertain condition than it now is. It is to be hoped that astronomers may utilize this scheme on the occasion of the next total eclipse on the 16th of May, of next year. Eleven sketches and one lithograph plate of the corona accompany this report, but they do not exhibit any details of structure worthy of note. But by far the most importantant portion of Mr. Todd's report relates to the observations of duration of totality, which were made at his solicitation at numerous points along the northeast and southwest limits of total phase. This series of observations will afford a very accurate correction of the longitud of the node of the lunar orbit, whenever the geographical positions of the several stations have been determined with sufficient accuracy to be used in the computation.

NOTE ON SUN SPOTS IN JANUARY, 1881.

To the Editor of "SCIENCE:"

1st, at noon: 5 groups, 11 spots. One spot quite large and close to east edge. Air very tremulous, making observation bad.

7th, 3 P. M.: 1 group, 3 spots. Two are large; nearly north of centre. Air bad. Observation with spyglass, power 36.

8th, 1 P. M.: 1 group, 4 spots. Air very bad.

10th, Noon: 1 group, 6 spots. Air very bad. Power 50.

11th, 2½ P. M.: 2 groups, 9 spots. One group of 7 spots 3′ from west edge. Two little spots and faculæ at east edge. Air pretty good.

17th, Noon: 1 group, 2 spots. A large spot near halfway from centre to N. W. margin. Observation with spyglass, power 36.

24th, 10½ A. M.: 3 groups, 23 spots. 12 spots, 2 quite large, south of centre. Air poor.

28th, Noon: 5 groups, 66 spots. One quite large and 5 good size, near west edge. Only good observation this month. The sun was hid most of the time.

Telescope 4.6 inches aperture; Power 100, except otherwise noted.

The number of solar spots has been slowly increasing since March, 1879. But it looks likely that the next maximum will be considerably more than eleven years from the last one, which occurred about August, 1870. The following minimum was nearly nine years afterward. It is generally about seven years from maximum to minimum, then four years to the next maximum. So I think it probable that the period, this time, will be about thirteen years, making the next maximum in 1883.

WM. DAWSON.

SPICELAND, IND., February 2, 1881.

CHEMICAL NOTES.

FORMATION OF BASES FROM SUBSTITUTED ACID AMIDES.—O. Wallach and Iwan Kamenski conclude, from their experiments, that if a base is formed by the action of phosphorous penta-chloride from a substituted amide of monobasic acids with a short carbon chain, two molecules of the amide enter into reaction in such a manner that hydrogen is derived from the hydrocarbon radicle pertaining to the acid in order to form hydrochloric acid.

ZINC CHLORIDE AS A REAGENT FOR ALKALOIDS, GLYCOSIDES, ETC.—A. Jorissen has found that the following bodies produce characteristic reactions with pure zinc chloride: Strychnine, bright rose; thebaine, yellow narceine, olive-green, delphinine, brownish red, berberine, yellow; veratrine, red; quinine, pale green; digitaline, chesnut-brown, salicine, violet-red; santonine, violet-blue; cubebine, carmine red. In case of strychnine the reaction can be produced with 1 decimilligrm. of the hydrochlorate. Brucine and aconitine, if present, interfere. To obtain the blue coloration characteristic of santonine, the mixture during evaporation must be continually stirred with a glass rod drawn out to a point. Digitaline gives first a green solution, similar to that produced by heating with hydrochloric acid. After evaporation there remains upon the porcelain a chestnut-brown spot which quickly blackens. The salicine reaction can be used for detecting the fraudulent addition of this body to quinine sulphate. Albumenoid substances, if heated for a time with the zinc chloride solution, leave a violet stain upon the porcelain, which may be distinguished by its instability from the colorations mentioned above. As a rule it quickly blackens. The author's method of operating is as follows: A solution of the alkaloid or its hydrochlorate is evaporated to dryness upon the water-bath, say in the inside of the lid of a porcelain crucible; two or three drops of the test-solution—1 grm. fused zinc chloride in 30 c.c. concentrated hydrochloric acid and 30 c.c. water—are placed upon the residue, and dried up afresh on the water-bath. The coloration begins at the outer edge and spreads inwards as the water is expelled.

BOOKS RECEIVED.

ON CERTAIN CONDITIONS OF NERVOUS DERANGEMENT. By William A. Hammond, M.D. Published by G. P. Putnam's Sons, 182 Fifth Avenue, New York, 1881.

The recent lecture of Dr. Beard before the New York Academy of Sciences, on "Mesmeric Trance," appears to have revived an interest in this subject, and new works bearing on Hypnotism are promised by those who have of late given attention to the phenomena in question.

The work before us by Dr. Hammond, therefore, comes at an opportune moment, for it not only explains very fully the author's views on "Hypnotism," but all the other conditions of nervous derangement which are evidently allied to the same class of mental disturbances. Thus we have chapters on Somnambulism, natural and artificial, including Hypnotism, various phases of Hysteria, the Hysteroid Affections, Stigmatization, Supernatural cures. Some of the causes which lead to sensorial deception and delusional beliefs.

Although the present work is a reprint of a previous book published by the author in 1876, Dr. Hammond states that he has thoroughly revised, and added largely to the subjects now considered, and also "omitted every thing specially relating to spiritualism."

Turning to the subject of Hypnotism, we are somewhat surprised to find it classed under the heading of Artificial Somnambulism, especially as we understood Dr. Hammond to state in a recent lecture before the University of the city of New York, that he attributed the phenomena to quite another cause, and for this reason he proposed to dispense with the term Hypnotism, which implies "sleep," and suggested the introduction of the word "Syggnosticism," meaning union of thought, or sympathy of thinking between two persons. The subject is also complicated by finding two such authorities as Dr. Hammond and Dr. Beard giving conflicting explanations of the phenomena.

Studying the one case of Hypnotism given by Dr. Hammond as the result of his experience, it appears to come to any other conclusion than that the phenomena presented in Hypnotism are merely manifestations of disease.

The instance we refer to was that of a young lady of great personal attractions, who up to a certain time was in a normal condition.

We first find that her nervous organization became depressed and demoralized by a great domestic bereavement, and further prostrated by fatigue, excitement and grief. The trouble commences by the young lady showing symptoms of chorea, the muscles of the face being in almost constant motion. The next step was that she talked in her sleep, and later she walked in her sleep and became a confirmed somnambulist. In the latter condition she walked about the house, struck a match and lighted the gas, seated herself in a chair and looked fixedly at the portrait of her lost mother.

While gazing at the picture she was subjected to various experiments by Dr. Hammond, her olfactory nerves received no impression from the fumes of sulphurous acid gas; she failed to perceive the sour taste of lemons or the bitter taste of quinine; scratching the back of her hand with a pin, pulling her hair and pinching her face appeared to excite no sensation, thus exhibiting all the phenomena of Hypnotism.

The next stage of this case develops a power in the patient of inducing the hypnotic state at will. Her process was to fix her attentions by reading a book and fixing her eyes steadily to reflect as if in a reverie, when she would presently pass to a perfect hypnotic condition.

Without professing to give a final opinion on the phenomena of Hypnotism, we direct attention to this authentic case presented by Dr. Hammond as showing what appears to be the evolution of Hyprotism.

First we find the subject in health, with all the functions and conditions of life normal. Secondly, the body and nervous organization is subjected to a great mental strain, developing a modified Hypnotic condiition. Thirdly, the disease becomes chronic and all the phenomena of Hypnotism are established and the patient is subject to hysteria, catalepsy and ecstasy, three conditions Dr. Hammond considers present in confirmed Hypnotism. There must be a final stage, the form of which may depend on circumstances. Under judicious treatment perhaps a normal condition of the nervous system may be restored, while, on the contrary, a further development of the disease may result in a total breaking up of the nervous system, followed by mania.

These reflections are suggested by the work before us, but in the present condition of the question it is impossible to arrive at any satisfactory conclusion. Drs. Hammond and Beard are not agreed even on the fundamental principles involved, and the former employs two terms for the phenomena, which are antagonistical to each other. It is therefore evident that ample opportunity is presented for a more thorough examination of the question, the result of which would doubtless improve our knowledge of mental diseases, many of which are at present inexplicable.

PAPILIO.—Devoted to Lepidoptera exclusively.—Vol. 1, No. 1, January, 1881.—Mr. Henry Edwards, No. 185 East 116th street, New York City.

This Journal is the authorized organ of the New York Entomological Club, and will be issued about the fifteenth of each month (excepting the two mid-summer months) the subscription being $2 per annum.

The first number contains many articles of interest to entomologists, and a full-page colored illustration of the beautiful insect Edwardsia brillians, from a specimen captured in N. W. Texas by the late Jacob Boll.

Entomologists will welcome this Journal, which in the hands of Mr. Henry Edwards will, doubtless, be maintained at a high standard, aod command success.

USE OF GLASS-WOOL IN FILTRATION.—F. Stolba and R. Böttger. Both these authors point out that glass-wool is attacked by various liquids, including hot water.

DETECTION OF PRE-FORMED UROBILINE IN URINE.—One hundred c.c. of urine are gently shaken up with 50 c.c. of perfectly pure ether; the ether decanted off and evaporated. The residue is taken up in absolute alcohol, and is rose-colored with a green fluorescence. The experiment does not always succeed.—E. SALKOWSKI.

A COLORING MATTER FROM CARBON DISULPHIDE.—If carbon disulphide is agitated with semi-fluid sodium amalgam, and if the paste-like mass is mixed with water, there is produced a hyacinth red liquid, whilst mercury and mercury sulphide are deposited. The solution contains the sodium salt of a yet unknown acid, somewhat soluble in hot water, and more readily in alcohol. It dyes yellow, orange, and brown shades on wool and silk.—C. REICHL.—*Polyt. Notizblatt*, 35, 151.

HOMOFLUORESCEINE: A NEW COLORING MATTER FROM ORCINE AND ITS DERIVATIVES.—On heating solutions of orcine with caustic alkalies and chloroform, the liquid becomes purple and then fiery red, and on dilution shows a strong greenish yellow fluorescence. This reaction is exceedingly sensitive. On neutralizing and adding bromine water a compound is formed from the fluorescent coloring matter resembling eosine; its alkaline alcoholic solutions appear cherry-red by transmitted light with yellow fluorescence. Though many of these compounds have splendid colors, only the nitro-derivatives are suitable for dyeing. Hexa-nitro-mono-oxy-homo-fluoresceine dyes silk a brilliant orange, the penta-nitro-diazo-amido-monoxy-homo-fluoresceine compounds a gold yellow and cyamic acid a light reddish yellow.—H. SCHWARZ.